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# (54) Machine for the production of spirally wound tubes from sheet metal strip

(57) A machine for the production of spirally wound tubes from sheet-metal strip in which the strip 2 is conveyed from a stock reel 4 obliquely on to a mandrel 1. The novel feature of the invention is that the mandrel is rotatable and driven by a motor 15 with variable speed transmission, wherein an idling pressure roller 13 is provided to keep the strip pressed against the rotating mandrel so that, by frictional engagement with the mandrel, the strip is pulled out from the stock reel and wound in spiral around the rotating mandrel. An angularly adjustable feed guide (7, 8), 9, 10 and cut-off device 17, 18 are provided.

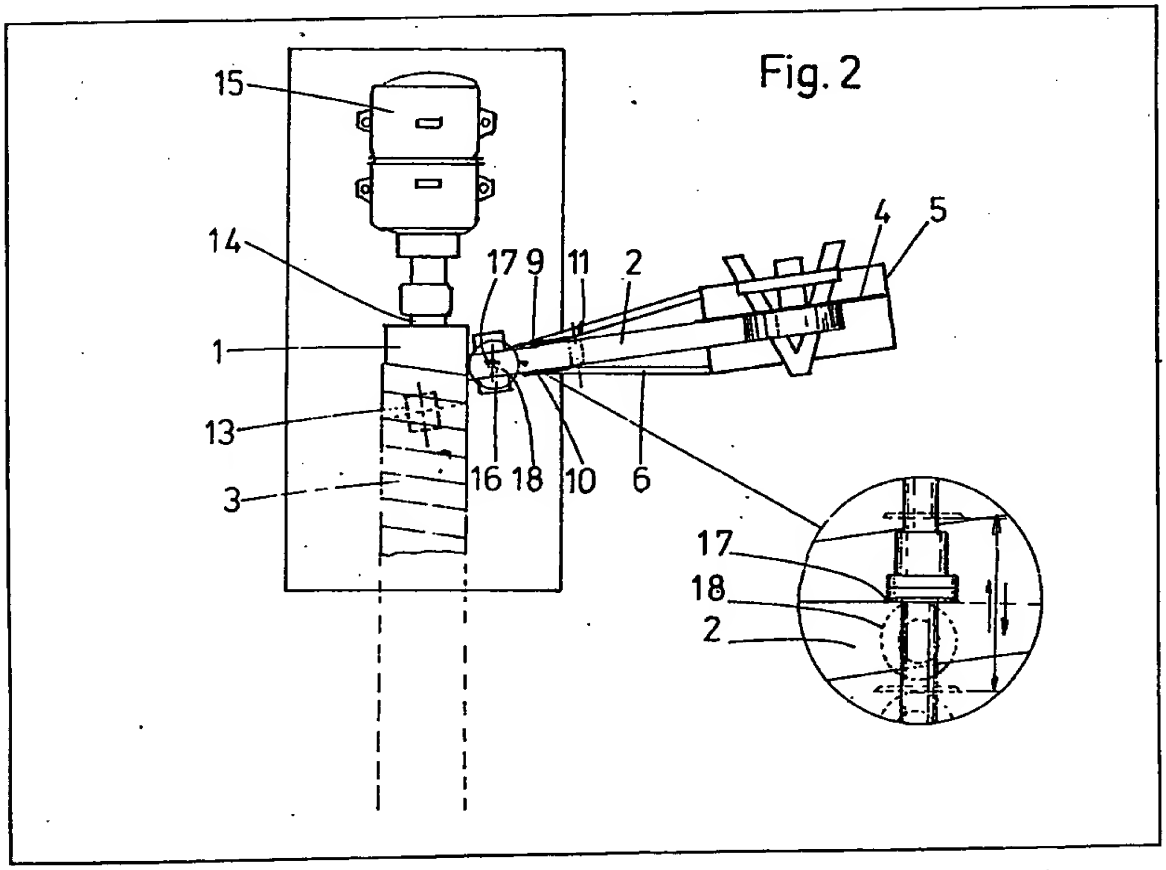


Fig. 2

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Fig.1

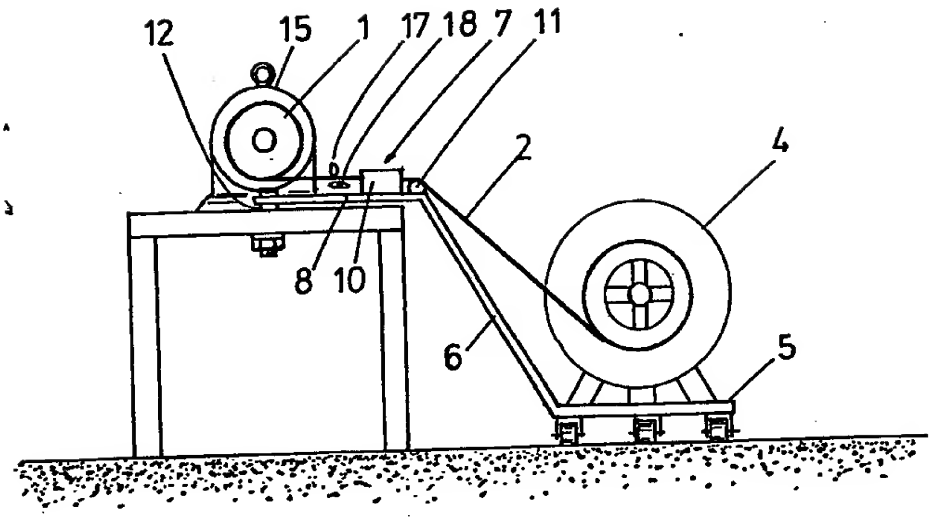
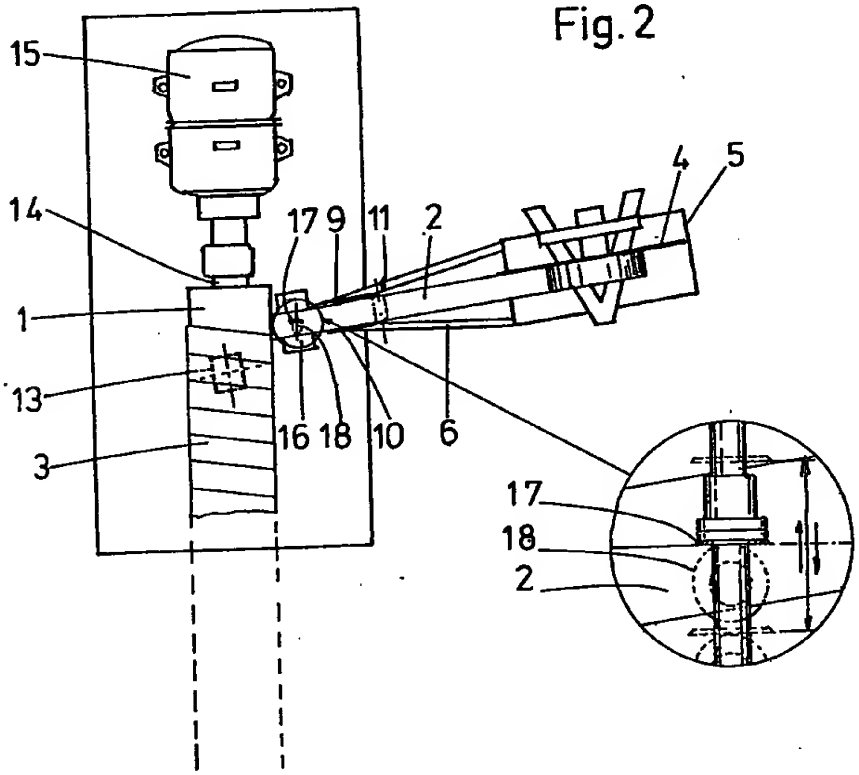



Fig. 2



SPECIFICATION

# Machine for the production of spirally wound tubes from sheet metal strip

*Background of the invention*

The present invention relates to a machine for the production of spirally wound tubes from sheet-metal strip.

The type of machine for the production of spirally wound sheet-metal tubes heretofore used comprises driven pairs of rollers for pulling out the strip to be spirally wound from a stock reel and pushing it forwards on to a stationary cylindrical mandrel, and strip forming rollers by means of which the edges of the strip are shaped for subsequent folding. Arranged between the roller train and mandrel is a strip guiding device to prevent the strip from crumpling prior to winding on the stationary mandrel. Subsequently to pre-profiling the edges, the strip is fed tangentially over the mandrel at an angle to the geometrical diametrical plane of the mandrel such that the edge profiles are in overlapping relationship in the turns thereby forming a joint which is thereafter folded by means of a freely rotatable press-roller which is kept pressed against the joint between the edges of the wound strip. For the purpose of reducing the friction between the stationary mandrel and the strip passing over it in the course of the winding operation, the strip is cooled by addition of a cooling liquid such as, by way of example, a soap solution, which reduces the friction between the strip and the mandrel and thereby also cools the mandrel.

A continuous tube is fed out from the mandrel and then cut into lengths. To this end, in the conventional machines a cross-cut saw is provided beyond the mandrel by means of which the tube is cut into the desired lengths.

Frequently, at least some of the driving rollers for feeding the strip to the mandrel are corrugated or knurled to increase the engagement with the surfaces of the strip, and the rollers are driven by a motor with variable speed transmission.

The conventional type of tube winding machine briefly described above suffers from a number of problems.

One of the most serious problems has been the noise arising during the cutting of such tubes. By way of example, the cutting of tubes 400 mm in diameter with a finely toothed saw blade produces a piercing noise at a level of about 110-120 dB A when the saw blade at a high rotational speed repeatedly works itself through the rotating tube.

Another disadvantage of cutting off the tube by means of a saw blade is the necessity of substantially reducing the machine speed during the cutting operation, thus resulting in a poor utilization of the machine capacity.

These drawbacks have now been remedied by the provision of a cutting device which is the subject of our Swedish Patent 7800535-2 and enables continuous cutting of the strip by means of circular knives prior to its winding around the mandrel. The strip is cut at an angle adapted to the diameter of the finished tube, said angle being the smaller the larger the tube diameter, for example 18° for a 100 mm tube and 4.5° for a 400 mm tube at a strip width of 100 mm. In this way the noise problem was eliminated completely and, moreover, the additional advantage was attained that the machine can be operated continuously without the need of reducing the feed speed in the course of the tube's cutting into lengths.

Thus, with the above-mentioned cutting device a radical improvement of the conventional tube winding machine was attained which, however, turned out still to suffer from serious drawbacks. The strip must be rinsed with a cooling liquid to reduce the friction and cool the stationary mandrel. Moreover, without the cutting device provided by us, i.e., with the earlier cutting of the tube by means of a saw blade, splashes and mist of cooling liquid mixed with chips and particles from the sheet material are ejected in the surrounding room creating an environment injurious to health. Certainly, the injurious environmental aspect of using a cooling liquid is eliminated with the cutting device provided by us but, nevertheless, the handling thereof implies a drawback and a reduced output of the process as such.

Another inconvenience of the conventional tube winding machine resides in the fact that the strip is pushed up to the stationary mandrel by means of the feed rollers. However, this presupposes that the strip must not be too thin, nor be composed of a soft metal such as aluminum. Practice has shown that the smallest workable thickness for aluminum sheet as well as galvanized sheet is about 0.5 mm, and that the largest possible thickness for galvanized sheet is about 1 - 1.2 mm. However, there is also a great demand for tubing made from thinner as well as from thicker sheet material.

*Summary of the invention*

According to the present invention, there is provided a machine for the production of spirally wound tubes which eliminates the need of driven feed rollers, and which enables spiral winding of tubes from metal strip with thicknesses of down to 0.2 mm, even sheet aluminum, and up to 4 mm, even sheet iron.

The machine according to the invention comprises:

a) a cylindrical mandrel with horizontally disposed cylinder axis for spiral winding of the strip;

b) a guiding device adjustable with respect to the vertical axis of a geometrical diametral plane through the mandrel for the purpose of guiding the strip unwinded from a stock reel towards the mandrel with an acute angle calculated with respect to the width of the strip and the diameter of the mandrel; and

c) a pressure roller working against the mandrel, wherein said mandrel is carried at one of its ends by a shaft which is connected to a driving motor with variable speed transmission, said mandrel being adapted, in cooperation with said pressure roller engaging the mandrel in idling relationship, through frictional engagement to pull out said strip from the

stock reel on to the mandrel for spiral winding around the rotating mandrel.

According to an embodiment of the invention, strip forming rollers are arranged on the guiding device between the stock reel and the mandrel for shaping the edges of the strip for subsequent folding by means of the afore-mentioned pressure roller.

*Brief description of the drawings*

The invention will now be described with reference to the drawing wherein Figure 1 is an elevational view and Figure 2 a plan view illustrating diagrammatically the tube winding machine according to the invention.

*Description of the invention*

The machine shown in Figures 1 and 2 comprises a cylindrical mandrel 1 for spiral wounding of a strip 2 to a tube 3. The strip 2 is taken from a stock reel 4 which is supported by a carriage 5. The carriage 5 is rigidly connected to a guiding device 7 by means of shafts 6 for tangential guiding of the strip towards the mandrel 1 at a predetermined acute angle to a geometrical diametral plane through the mandrel 1. The guiding device 7 comprises a bottom plate 8 having slide bars 9, 10 standing up from its side edges, and necessary guide rollers 11. The bottom plate is pivotally journalled on a bolt 12 centrally below the axis of the mandrel in the area of the tangential guiding of the strip on to the mandrel.

Arranged centrally below the axis of the mandrel is a conventional pressure roller 13, the only function of which in earlier tube winding machines is to fold the strip previously profiled at the edges. However, in the machine according to the invention, the pressure roller 13 also has another function, namely as a clamping element, as will be apparent below.

According to the invention, the mandrel 1 is connected by means of a shaft 14 to a driving motor 15 with a variable speed transmission 16. When the mandrel 1 is rotated, by frictional engagement between the mandrel 1 and the pressure roller 13, the strip 1 is pulled out from the stock reel 4 and wound in spiral around the mandrel.

Preferably, also strip forming rollers are provided in a known manner on the strip guiding device 7 (not shown) for the production of folded tubes, in which case the strip of course is wound with the edges in overlap. In absence of strip forming rollers the strip will be wound edge to edge, which is of interest particularly in the case of strips of stainless sheet-metal, or iron sheet with thicknesses of up to 4 mm, in which case the edges are butt-welded.

In Figure 2, a strip cutting device 16 with rotary knives 17, 18 according to our Swedish Patent 7800535-2 is shown very schematically. This device may be used only for thin sheet-metal, the strip guiding device being then also provided with strip forming rollers and the strip folded in the joints by means of the pressure roller 13.

With the tube winding machine according to the invention an essential simplification of the mechanical equipment is obtained, and an essential widening of the workable range of thicknesses for the strip material is obtained. By way of example, owing to the fact that the strip will be pulled out by the rotating mandrel, it is possible from 0.2 mm aluminum strip to wind tubes with diameters of 65 - 300 mm, which has not been possible with machines previously known.

Although the invention is described in detail in respect to the example and the drawings, it will be clear that modifications in materials and structure can be made by those skilled in the art within the scope of the invention as defined in the appended claims.

CLAIMS

1. Machine for continuous production of spirally wound tubes from sheet strip, comprising:

a) a cylindrical mandrel with horizontally disposed cylinder axis for spiral winding of the strip;

b) a guiding device adjustable with respect to the vertical axis of a geometrical diametral plane through the mandrel for the purpose of guiding the strip unwinded from a stock reel towards the mandrel with an acute angle calculated with respect to the width of the strip and the diameter of the mandrel; and

c) a pressure roller working against the mandrel, wherein said mandrel is carried at one of its ends by a shaft which is connected to a driving motor with variable speed transmission, said mandrel being adapted, in cooperation with said pressure roller engaging the mandrel in idling relationship, through frictional engagement to pull out said strip from the stock reel on to the mandrel for spiral winding around the rotating mandrel.

2. The machine of claim 1 wherein strip forming rollers are provided on the guiding device in a manner known per se for shaping the edges of the strip for subsequent folding on the mandrel by means of said pressure roller.

3. The machine of claim 1 wherein a pair of cooperating rotary knives are provided on the strip guiding device for cutting the strip obliquely to the longitudinal direction prior to pulling it to the mandrel.

4. Machine for continuous production of spirally wound tubes from sheet strip substantially as herein described with reference to and as shown in the accompanying drawings.

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